

<b>Notice of Allowability</b>	<b>Application No.</b>	<b>Applicant(s)</b>
	09/852,339	MIROTCHNIK ET AL.
	Examiner Tiffany A Fetzner	Art Unit 2859

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS**. This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1.  This communication is responsive to 04/02/2004 & the telephonic interviews of 4/29/2004 and 04/30/2004.
2.  The allowed claim(s) is/are 1-11.
3.  The drawings filed on \_\_\_\_\_ are accepted by the Examiner.
4.  Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a)  All    b)  Some\*    c)  None    of the:
    1.  Certified copies of the priority documents have been received.
    2.  Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
    3.  Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.  
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5.  A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
6.  CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
  - (a)  including changes required by the Notice of Draftsperson's Patent Drawing Review ( PTO-948) attached
    - 1)  hereto or 2)  to Paper No./Mail Date 04/30/04.
  - (b)  including changes required by the attached Examiner's Amendment / Comment or in the Office action of
 Paper No./Mail Date 04/30/04.
7.  DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

#### Attachment(s)

1.  Notice of References Cited (PTO-892)
2.  Notice of Draftperson's Patent Drawing Review (PTO-948)
3.  Information Disclosure Statements (PTO-1449 or PTO/SB/08),  
Paper No./Mail Date \_\_\_\_\_
4.  Examiner's Comment Regarding Requirement for Deposit  
of Biological Material
5.  Notice of Informal Patent Application (PTO-152)
6.  Interview Summary (PTO-413),  
Paper No./Mail Date 04/30/2004.
7.  Examiner's Amendment/Comment
8.  Examiner's Statement of Reasons for Allowance
9.  Other \_\_\_\_\_.

**Examiner's Amendment**

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.
2. Authorization for this examiner's amendment was given in a telephone interview with Attorney **Edward (Ted) Yoo** Reg. No. 41,345 on April 30, 2004.
3. The application has been amended as follows:

**In the claims:**

- A) Replace RCE claim 1, with the following Examiner Amended claim 1:**

**---Claim 1** A method of determining the oil fraction of a fluid emulsion comprising heavy oil/bitumen and water by direct measurement comprising the steps of:

- (a) providing a low field NMR relaxometer;
- (b) measuring and recording the  $T_2$  relaxation spectrum of the emulsion at a temperature allowing recovery of the  $T_2$  spectrum of the heavy oil/bitumen, substantially separate from a  $T_2$  water peak;
- (c) determining a distinguishing  $T_2$  cutoff value;
- (d) measuring the total amplitude ( $A_{oil}$ ) of the spectrum at  $T_2$  times less than and equal to the  $T_2$  cutoff value;
- (e) converting  $A_{oil}$  to a weight value by dividing  $A_{oil}$  by the amplitude index of an oil standard ( $AI_{oil}$ ) of known weight; and
- (f) using the weight value to determine the oil fraction of the fluid emulsion.

- B) Replace RCE claim 3, with the following Examiner Amended claim 3:**

**---Claim 3** A method of determining the water fraction of a fluid emulsion comprising heavy oil/bitumen and water by direct measurement comprising the steps of:

- (a) providing a low field NMR relaxometer;
- (b) measuring and recording the  $T_2$  relaxation spectrum of the emulsion
- (c) determining a distinguishing  $T_2$  cutoff value;
- (d) measuring the total amplitude ( $A_w$ ) of the spectrum at  $T_2$  times greater than the  $T_2$  cutoff value;
- (e) converting  $A_w$  to a weight value by dividing  $A_w$  by the amplitude index of a water standard ( $Al_w$ ) of known weight; and
- (f) using the weight value to determine the water fraction. -----

**C) Replace RCE claim 5, with the following Examiner Amended claim 5:**

**---Claim 5** An apparatus determining by direct measurement the oil fraction of a flowing fluid emulsion comprising heavy oil/bitumen and water comprising:

- (a) a low field NMR relaxometer having a NMR magnet positioned in proximity to a channel through which the emulsion flows, said relaxometer for measuring the  $T_2$  spectrum of a sample, at a temperature allowing recovery of the  $T_2$  spectrum of the heavy oil/bitumen, substantially separate from a  $T_2$  water peak;
- (b) means for identifying a distinguishing  $T_2$  cutoff value;
- (c) means connected to the relaxometer for measuring total  $T_2$  amplitude below the  $T_2$  cutoff value, wherein a substantial portion of the spectrum attributable to the oil is at  $T_2$  values less than or equal to the  $T_2$  cutoff value;
- (d) means for converting the total  $T_2$  amplitude value to a weight value; and
- (e) means for determining the weight value to determine the oil fraction of the fluid emulsion. -----

**D) Replace RCE claim 10, with the following Examiner Amended claim 11:**

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**--Claim 10** An apparatus determining by direct measurement the oil fraction of a fluid emulsion comprising heavy oil/bitumen and water comprising:

- (a) means for obtaining a sample of the emulsion;
- (b) a low field NMR relaxometer measuring the  $T_2$  spectrum of the sample at a temperature allowing recovery of the  $T_2$  spectrum of the heavy oil/bitumen, substantially separate from a  $T_2$  water peak;
- (c) means for identifying a distinguishing  $T_2$  cutoff value;
- (d) means connected to the relaxometer for measuring total  $T_2$  amplitude below the  $T_2$  cutoff value, wherein a substantial portion of the spectrum attributable to the oil is at  $T_2$  values less than or equal to the  $T_2$  cutoff value;
- (e) means for converting the total  $T_2$  amplitude value to a weight value; and
- (f) means for determining the weight value to determine the oil fraction of the fluid emulsion. -----

**E) Replace RCE claim 11, with the following Examiner Amended claim 11:**

**--Claim 11** A method of determining by direct measurement the oil fraction and water fraction of a fluid emulsion comprising heavy oil/bitumen and water comprising the steps of:

- (a) providing a low field NMR relaxometer;
- (b) measuring and recording the  $T_2$  relaxation spectrum of the emulsion at a temperature allowing recovery of the  $T_2$  spectrum of the heavy oil/bitumen, substantially separate from a  $T_2$  water peak;
- (c) determining a distinguishing  $T_2$  cutoff value;
- (d) measuring the total amplitude ( $A_{oil}$ ) of the spectrum at  $T_2$  times less than and equal to the  $T_2$  cutoff value;
- (e) converting  $A_{oil}$  to a weight value by dividing  $A_{oil}$  by the amplitude index of an oil standard ( $AI_{oil}$ ) of known weight;
- (f) measuring the total amplitude ( $A_w$ ) of the spectrum at  $T_2$  times greater than the  $T_2$  cutoff value;

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(g) converting  $A_w$  to a weight value by dividing  $A_w$  by the amplitude index of a water standard ( $AI_w$ ) of known weight; and

(h) using the oil weight value and the water weight value to determine the oil fraction and water fraction respectively. -----

**In the Specification:**

**A) Replace original disclosure page 1 lines 25-31 with the following examiner amended paragraph:**

Low field Nuclear Magnetic Resonance (NMR) relaxometry techniques have been developed in the laboratory to enhance and support comparable NMR logging tools that are currently used downhole. **Low field NMR relaxometry involves relaxometers operating at about 2Mhz or less.** Low field NMR relaxometry has shown that discrimination of water and oil saturation in core and ore can be easily determined. In such cases the NMR can detect the total water weight fraction and the total oil weight fraction, the viscosity of the oil, the amount of bound or mobile water and the amount of mobile or bound oil. -----

**B) Replace original disclosure page 2 line 25 through page 4 line 25 with the following examiner amended paragraphs:**

Therefore, in one aspect of the invention, there is provided a method of determining the oil fraction of a fluid emulsion comprising heavy oil/bitumen and water by direct measurement comprising the steps of:

(a) providing a low field NMR relaxometer;

(b) measuring and recording the  $T_2$  relaxation spectrum of the emulsion at a temperature allowing recovery of the  $T_2$  spectrum of the heavy oil/bitumen, substantially separate from a  $T_2$  water peak;

(c) determining a distinguishing  $T_2$  cutoff value;

- (d) measuring the total amplitude ( $A_{oil}$ ) of the spectrum at  $T_2$  times less than and equal to the  $T_2$  cutoff value;
- (e) converting  $A_{oil}$  to a weight value by dividing  $A_{oil}$  by the amplitude index of an oil standard ( $AI_{oil}$ ) of known weight; and
- (f) using the weight value to determine the oil fraction of the fluid emulsion.

In another aspect, the invention comprises a method of determining the water fraction of a fluid emulsion comprising heavy oil/bitumen and water by direct measurement comprising the steps of:

- (a) providing a low field NMR relaxometer;
- (b) measuring and recording the  $T_2$  relaxation spectrum of the emulsion
- (c) determining a distinguishing  $T_2$  cutoff value;
- (d) measuring the total amplitude ( $A_w$ ) of the spectrum at  $T_2$  times greater than the  $T_2$  cutoff value;
- (e) converting  $A_w$  to a weight value by dividing  $A_w$  by the amplitude index of a water standard ( $AI_w$ ) of known weight; and
- (f) using the weight value to determine the water fraction.

In another aspect, the invention comprises an apparatus determining by direct measurement the oil fraction of a flowing fluid emulsion comprising heavy oil/bitumen and water comprising:

- (a) a low field NMR relaxometer having a NMR magnet positioned in proximity to a channel through which the emulsion flows, said relaxometer for measuring the  $T_2$  spectrum of a sample, at a temperature allowing recovery of the  $T_2$  spectrum of the heavy oil/bitumen, substantially separate from a  $T_2$  water peak;
- (b) means for identifying a distinguishing  $T_2$  cutoff value;

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(c) means connected to the relaxometer for measuring total  $T_2$  amplitude below the  $T_2$  cutoff value, wherein a substantial portion of the spectrum attributable to the oil is at  $T_2$  values less than or equal to the  $T_2$  cutoff value;

(d) means for converting the total  $T_2$  amplitude value to a weight value; and

(e) means for determining the weight value to determine the oil fraction of the fluid emulsion.

In yet another aspect, the invention comprises an apparatus determining by direct measurement the oil fraction of a fluid emulsion comprising heavy oil/bitumen and water comprising:

(a) means for obtaining a sample of the emulsion;

(b) a low field NMR relaxometer measuring the  $T_2$  spectrum of the sample at a temperature allowing recovery of the  $T_2$  spectrum of the heavy oil/bitumen, substantially separate from a  $T_2$  water peak;

(c) means for identifying a distinguishing  $T_2$  cutoff value;

(d) means connected to the relaxometer for measuring total  $T_2$  amplitude below the  $T_2$  cutoff value, wherein a substantial portion of the spectrum attributable to the oil is at  $T_2$  values less than or equal to the  $T_2$  cutoff value;

(e) means for converting the total  $T_2$  amplitude value to a weight value; and

(f) means for determining the weight value to determine the oil fraction of the fluid emulsion.

In another aspect, the invention comprises a method of determining by direct measurement the oil fraction and water fraction of a fluid emulsion comprising heavy oil/bitumen and water comprising the steps of:

(a) providing a low field NMR relaxometer;

- (b) measuring and recording the  $T_2$  relaxation spectrum of the emulsion at a temperature allowing recovery of the  $T_2$  spectrum of the heavy oil/bitumen, substantially separate from a  $T_2$  water peak;
- (c) determining a distinguishing  $T_2$  cutoff value;
- (d) measuring the total amplitude ( $A_{oil}$ ) of the spectrum at  $T_2$  times less than and equal to the  $T_2$  cutoff value;
- (e) converting  $A_{oil}$  to a weight value by dividing  $A_{oil}$  by the amplitude index of an oil standard ( $AI_{oil}$ ) of known weight;
- (f) measuring the total amplitude ( $A_w$ ) of the spectrum at  $T_2$  times greater than the  $T_2$  cutoff value;
- (g) converting  $A_w$  to a weight value by dividing  $A_w$  by the amplitude index of a water standard ( $AI_w$ ) of known weight; and
- (h) using the oil weight value and the water weight value to determine the oil fraction and water fraction respectively.

#### **Examiner's Comment**

4. Original Specification support is found for all of the examiner amendments made, from the original disclosure and the originally provided claims.
5. The replacement of the specification paragraphs on page 2 line 25 through page 4 line 25 were made so that the specification would reflect the examiner amended claims, because each embodiment in that part of the specification is a summary version of each of the applicant's independent claims.
6. The amended specification and claims are considered to be free of new matter by the examiner.
7. The amendments made by the examiner reflect the applicant's proposal to the examiner from the April 29<sup>th</sup> 2004 and April 30<sup>th</sup> 2004 telephonic interviews, which are attached in markup form to the end of this action.
8. The applicant granted the examiner permission to make the proposed amendments in order to place the application in condition for allowance.

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9. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103( c ) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

**Priority**

10. Acknowledgment is made of applicant's claim for foreign priority based on an application filed in Canada on March 26th 2001. The priority document was received 02/18/2004 therefore applicant has now met all of the requirements for foreign priority based on the application filed in Canada on March 26th 2001, and the effective priority date for the instant application is now March 26th 2001 as opposed to applicant's filing date of May 11th 2001.

**Drawings**

11. New corrected drawings are required in this application because the drawings filed May 11<sup>th</sup> 2001 do not meet the official draftsperson's criteria for Formal Drawings. A complete new set of Drawings which meet the requirements of the attached PTO 948 official draftsperson's review attached to this action is required.

12. Applicant is advised to employ the services of a competent patent draftsperson outside the Office, as the U.S. Patent and Trademark Office no longer prepares new drawings. The corrected Formal drawings are required in reply to the Office action to avoid abandonment of the application. The requirement for corrected drawings will not be held in abeyance.

**Response To Arguments**

13. Applicant's After-final arguments filed February 17<sup>th</sup> 2004 and the arguments filed with the response of October 29th 2003 [See the Remarks pages 2-3 of the October 29th 2003 response; and Remarks page 5 of the February 17<sup>th</sup> 2004 response], are persuasive in view of the March 26<sup>th</sup> 2004 RCE amendments to the claims which clarifies that applicant's claims are drawn to oil/bitumen fractions and water fractions of fluid emulsions as opposed to oil / water content of fluid emulsions. Therefore the **Flaum et al.**, reference is non longer considered to be prior art against the claims of the instant application.

14. The examiner notes that a fraction of an emulsion is different from the content of an emulsion because the content includes all possible components that make up oil, water, some other fluid and the identification of each type of fluid present; while a fraction includes only a portion, or part of the component fluids, in relation to (i.e. how much of) the other fluids, or the entire emulsion is present. The terms content and fraction are neither synonymous, nor equivalent.

15. The following is an examiner's statement of **reasons for allowance**:

16. **Examiner amended independent claims 1, 3, 5, 10, and 11** are considered to be allowable over the prior art of record because the prior art of record fail to teach or suggest a method or apparatus that is able to determine by direct measurement the oil / bitumen fraction of a fluid emulsion; the water fraction of a fluid emulsion; and the oil / bitumen fraction along with the water fraction of a fluid emulsion, with a low field NMR relaxometer. In the prior art 20Mhz. NMR devices have been shown to determine the fraction of oil / water in FRENCH salad dressing, which is a fluid emulsion, but a 20Mhz NMR relaxometer is not a low-field relaxometer. Low-field relaxometers operate with a frequency of about 2Mhz, or less. Therefore, medium to high NMR relaxometer methods are outside the scope of the instant invention. One of applicant's

features of novelty is the ability to make the fractional measurements of the emulsion directly with a low-field NMR relaxometer by using the T<sub>2</sub> spectrum and T<sub>2</sub> cutoffs with respect to the appropriate weight considerations as set forth and claimed in each of applicant's examiner amended independent claims.

17. The prior art of record which do use low field NMR relaxometers determine only if water, heavy oil / bitumen is present in a fluid, or fluid emulsion such as oil based mud; or perform an estimate of the respective fractions from other measurements such as porosity, BVI FFI, viscosity, etc., The prior art does not directly measure: the oil / bitumen fraction of a fluid emulsion; the water fraction of a fluid emulsion; and the oil / bitumen fraction along with the water fraction of a fluid emulsion method which uses of a fluid emulsion. The examiner notes that the prior art teaches away from applicant's method entirely because the prior art teaches that low-field NMR devices are incapable of measuring / determining an accurate oil / bitumen fraction of a fluid emulsion; water fraction of a fluid emulsion; or the oil / bitumen fraction along with the water fraction of a fluid emulsion because at low-field frequencies the appropriate signals cannot be distinguished. The prior art fails to recognize applicant's novelty that the weight of the fractional components, considered as claimed by applicant based on the T<sub>2</sub> spectrum is capable of overcoming a problem, recognized but not solved by the prior art with a low-field nmr relaxometer.

18. It is the combination of each of the features set forth in the examiner amended independent claims that is the feature of novelty in each of applicant's

examiner amended independent claims and it is the combination of features that distinguishes applicant's application from the prior art.

19. It would not have been obvious to one of ordinary skill in the art, at the time that the invention was made to use a low-field relaxometer in performing a direct measurement of the oil / bitumen fraction of a fluid emulsion; water fraction of a fluid emulsion; or the oil / bitumen fraction along with the water fraction of a fluid emulsion because the methods and apparatuses claimed teach away from what is known in the art, and are therefore considered to be both novel and nonobvious by the examiner.

20. With respect to **dependent claims 2, 4, and 6-9**, which respectively depend from **examiner amended independent claims 1, 3, and 5**, each of these claims are considered to be allowable by the examiner because they depend from an allowable **examiner amended independent claim**, therefore the same reasons for allowance, novelty and nonobviousness, that apply to **examiner amended independent claims 1, 3, and 5**, also apply to Dependent claims **2, 4, and 6-9**, and need not be reiterated.

21. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

#### Prior Art made of Record

22. The **prior art made of record** and not relied upon is considered pertinent to applicant's disclosure.

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- A) **Flaum et al.**, US patent 6,140,817 issued October 31<sup>st</sup> 2000, filed May 26<sup>th</sup> 1998.
- B) **Prammer** US patent 6,107,796 issued August 22<sup>nd</sup> 2000, filed August 17<sup>th</sup> 1998.
- C) **Prammer** US Patent Application Publication 2002/0167314 A1 published November 14<sup>th</sup> 2002, filed June 5<sup>th</sup> 2001. This reference is not prior art because applicant's application has an earlier effective filing date, the reference is noted only for the purposes of a complete record.
- D) **Fairbrother et al.**, article "Measurement of oil in French dressing by Medium-resolution, proton magnetic resonance spectroscopy" Lab. Chim. Anal., Inst. Natl Agron., Paris, 75231, Fr. Analusis (1993), 21(2), 113-117.

### Conclusion

23. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tiffany Fetzner whose telephone number is: (571) 272-2241. The examiner can normally be reached on Monday-Thursday from 7:00am to 4:30pm., and on alternate Friday's from 7:00am to 3:30pm.

24. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diego Gutierrez, can be reached at (571) 272-2245. The **only official fax phone number** for the organization where this application or proceeding is assigned is **(703) 872-9306**.



TAF  
May 1, 2004



Diego Gutierrez  
Supervisory Patent Examiner  
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